

**DoD CONTRACT  
MANAGEMENT CONFERENCE**

**IMPACT '73**

**1968 DALLAS, TEXAS**

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**REPORT OF PANEL 3  
MANAGEMENT SCIENCE  
IN THE PROCUREMENT CYCLE**



DEFENSE SUPPLY AGENCY  
HEADQUARTERS  
CAMERON STATION  
ALEXANDRIA, VIRGINIA 22314

29 November 1968

To The Recipients of This Publication:

In the fall of 1968, a DoD Contract Management Conference was held in Dallas, Texas. Attending this conference were some of the foremost authorities in the field of contract management from both government and industry.

The objectives of this conference were to identify the major contract management problems of today and develop specific action programs for their resolution. These participants assembled to identify the long-range trends and problems in contract management and develop actions, plans, and goals to insure an effective and efficient operation in the future.

This publication is a record of the thoughts and ideas expressed at this meeting. It is a record which is being used in developing and implementing the recommendations expressed by these very able panel chairmen and conferees who worked so hard to produce this product.

A handwritten signature in black ink, appearing to read "J. L. Howard", is positioned above the typed name.

J. L. HOWARD  
Rear Admiral, SC, USN  
Chairman  
DoD Contract Management Conference

FINAL PANEL REPORT

Panel No. 3

MANAGEMENT SCIENCE IN

PROCUREMENT CYCLE

1968 DoD Contract Management Conference

IMPACT 73

PANEL NO. 3

MANAGEMENT SCIENCE IN THE PROCUREMENT CYCLE

PREFACE

This panel was joined to study the varied tools and techniques that have been developed in the field of management science. They reviewed the efforts made by CAS, and other elements of DoD, to apply these techniques, and they evaluated the success of those applications. Their purpose was to consider the potential uses of the more recent and advanced tools and techniques and to set forth, in a general way, new concepts for the development of scientific methods at all levels of CAS management.

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PANEL 3

MANAGEMENT SCIENCE IN

PROCUREMENT CYCLE

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BIOGRAPHICAL SKETCHES

PANEL NO. 3

1968 DoD CONTRACT MANAGEMENT CONFERENCE



COLONEL ALLAN B CHEALANDER  
AIR FORCE PLANT REPRESENTATIVE  
MCDONNELL DOUGLAS CORPORATION  
MISSILE & SPACE SYSTEMS DIVISION  
HUNTINGTON BEACH, CALIFORNIA

Colonel Chealander was appointed Air Force Plant Representative of McDonnell Douglas Corporation on October 30, 1967, upon his return from a tour of duty in South Vietnam. Prior to his duty in Southeast Asia, Colonel Chealander was Director of Quality Assurance, Air Force Contract Management Division, Los Angeles, California, during the period July 2, 1965 through October 20, 1966.

In June 1963 he was assigned Air Force Plant Representative at Lockheed Aircraft Company, Burbank, California; and prior to the Burbank assignment he was Air Force Plant Representative at the Rocketdyne Division, North American Aviation, Inc.

In August 1960 he completed the Air Force Training with Industry Program at the Boeing Airplane Company, Seattle, Washington.

From 1956 to 1959 Colonel Chealander served first as Project Officer and later as Chief of the Aircraft and Missile Branch, Quality Control Office, Hqs Air Materiel Command, Wright-Patterson Air Force Base, Ohio.

From 1950 to 1955 Colonel Chealander served in various Training Command assignments, principally as an Educational Staff Officer and Director of Instructor Training.

During World War II he flew B-17s with the 8th Air Force in England. In the 1948-49 time period he flew C-54s in the Berlin Airlift.

Colonel Chealander was born in Oakland, California, October 3, 1919. He graduated from the University of Southern California with a BS degree in 1948. He received his MBA from the University of California at Berkeley in 1956.

CAPTAIN ARTHUR W. HOLFIELD, JR.  
CONTRACTS OFFICER  
SUPERVISOR OF SHIPBUILDING,  
CONVERSION AND REPAIR, USN  
GROTON, CONNECTICUT

Captain Holfield graduated from the U. S. Naval Academy in June 1946 and was commissioned as Ensign in the Navy Supply Corps.

He has served as Contracts Officer, Supervisor of Shipbuilding, Conversion and Repair, USN, since July 1967. That office is responsible for the administration of contracts totaling approximately \$1.5 billion for the construction of nuclear submarines and for the overhaul and conversion of nuclear attack and Fleet Ballistic Missile (Polaris) submarines.

From July 1964 to July 1967 Captain Holfield was assigned to the Procurement Planning and Policy Division, Office of Naval Material. His duties involved implementation of DoD procurement policies, review of ASPR cases, replies to GAO and Congressional procurement matters, and administration of procurement training in Navy.

From July 1962 to July 1964 he served as Supply Planning Officer, Staff, Commander Service Squadron Three, based in Sasebo, Japan.

From July 1961 to July 1962 Captain Holfield was assigned as a student at the Command and Staff School, U. S. Naval War College, Newport, Rhode Island.

From July 1959 to July 1961 he served as Contracting Officer, Navy Special Projects Office. Procurement Contracting Officer for the development and production of the Polaris Missile and its associated equipment. Contracts awarded were in approximate amount of \$750 million per year.

From July 1957 to July 1959 Captain Holfield served as Assistant Supply Officer, USS SARATOGA (CVA 60), Forrestal Class Attack Aircraft Carrier.

From July 1954 to July 1957 he was assigned to Procurement Training and Directives Division, Bureau of Supplies and Accounts.

From April 1950 to August 1952 Captain Holfield served as Contracting Officer, Naval Aviation Supply Office, Philadelphia, Pennsylvania. Responsible for the procurement of aviation spare parts.

CURTIS B. WILLIAMS  
CHIEF, POLICY & MANAGEMENT OFC.  
PROCUREMENT & PRODUCTION DIR.  
U. S. ARMY MISSILE COMMAND

---

Assigned as Chief of the Policy and Management Office, Procurement and Production Directorate, U. S. Army Missile Command, in February 1968. I have held jobs in the Procurement and Production Directorate as Chief of Engineering and Documentation Division (3 yrs) and Chief of the Automatic Data Processing Systems Division (18 mos). Prior to my assignment to the Procurement and Production Directorate I was Chief of the Publications Div. of the Supply and Maintenance Directorate of this installation for 3 years. Prior to that time I was Chief of the Technical Training Branch of the Research and Development Directorate (3 yrs). I was responsible for developing new equipment courses on new guided missile systems. Prior to that I was assigned to the Training Department of the Ordnance Guided Missile School as Chief of the Doctrine and Standards Branch, and later became Director of Training(3 yrs).

I have been affiliated with the Naval Reserve for over 31 years and am still active as the Commandant's local representative. I graduated from the U. S. Naval Academy's post graduate school in Applied Communications in 1945. I attended various schools including Mid-shipman Training at Northwestern University while in the Navy. I also had ship board duty aboard small craft as well as battleship duty. I commanded two anti-submarine vessels during World War II. I had 6 years of active duty from 1940 through 1946. I have held the rank of Captain, USNR, since 1961.

Although my civil service career started in the area of training, my last assignments have been in management type positions involving large numbers of personnel.

I was born in Alabama on July 8, 1917. I graduated from Jacksonville State University, Jacksonville, Alabama, with a B.S. degree, majoring in math, in 1939. I did graduate work at Auburn University, and am now enrolled in the graduate program at the University of Oklahoma majoring in Public Administration. I expect to graduate in 1969.

I presently hold a staff position reporting directly to the Director of the Procurement and Production Directorate, who does all the buying of assigned Army guided missile systems, as well as the repair parts in support of them. Senior engineers, legal, procurement, production, technical training and management personnel are assigned to this office and are under my direct supervision.

MR. VERNON W. HEAD  
CHIEF, AUDIT AND PROCUREMENT ADMINISTRATION DIVISION  
OFFICE, CHIEF OF ENGINEERS  
WASHINGTON, D. C. 20315

Mr. Head was appointed as Chief, Audit and Procurement Administration Division, Office, Chief of Engineers, Washington, D. C., on 15 January 1968.

From May 1965 to January 1968 he was employed as an auditor in the Audit and Procurement Administration Division, Office, Chief of Engineers, Washington, D. C.

In June 1961 Mr. Head accepted the position as Assistant Chief, Procurement Administration Division, Office, Chief of Engineers, Washington, D. C.

From July 1958 to June 1961 he served as an auditor in the Audit Division, Office, Chief of Engineers, Washington, D. C.

During the ten years prior to 1958, Mr. Head was a member of the Audit Groups in the U. S. Army Engineer District, Tulsa, Oklahoma, and U. S. Army Engineer Division, Southwestern, Dallas, Texas.

During the last 15 years Mr. Head has devoted approximately 50% of his time involving procurement procedures and contract administration in Construction Contracting. He has attended a number of procurement schools, special courses in construction contracting and supply management.

Mr. Head was born in Foster, Oklahoma, November 16, 1913. He has a BCS degree in Accounting from attendance at Southeastern State College, Durant, Oklahoma, and Oklahoma School of Accounting, Tulsa, Oklahoma.

CAPTAIN GEORGE G. DUNN, SC, USN

Captain Dunn is the Director of the Procurement Policy and Planning Division, Office of the Deputy Chief of Naval Material (Procurement), Headquarters, Naval Material Command. This office, located in the Navy Department, Washington, D.C., is responsible for developing and implementing policy, plans and methods of Navy contracting; publishing the Navy Procurement Directives and the "Procurement Newsletter"; and developing and administering a program for the specialized training of Navy procurement personnel.

Captain Dunn was born and raised in New Jersey, entering the U.S. Merchant Marine Academy early during World War II. Upon graduation he was commissioned an ensign in the Navy. During his 24-year naval career he has had a variety of duty assignments both afloat and ashore.

He has studied at the University of Virginia, University of South Carolina and in 1962 received his Masters degree in Management from the U.S. Naval Post-graduate School, Monterey, California. He completed the Advanced Management Program at the Harvard Business School in 1967.

Prior to his present duty assignment, Captain Dunn was a contracting officer and Commodity Division Director in the Directorate of Procurement, Defense General Supply Center, Richmond, Virginia.

COLONEL CHARLES F. MERZ  
DEFENSE CONTRACT ADMINISTRATION SERVICES  
PLANT REPRESENTATIVE OFFICE  
SAN DIEGO, CALIFORNIA

Colonel Merz was appointed Commander, Defense Contract Administration Services (DCAS) Plant Representative Office, at General Dynamics Convair, San Diego in August 1968 from a previous assignment at Headquarters, Military Airlift Command (MAC), Scott Air Force Base, Illinois.

His assignment at Hq MAC was from June 1964 to July 1968 where he was first a procurement staff officer and later the Deputy Director of Procurement and Production. A major portion of the procurement activity here was the pricing and negotiation of contracts with U. S. Air Carriers for passenger and cargo Airlift Services to augment military airlift capability.

From June 1960 to June 1964 Colonel Merz served as Assistant Professor of Air Science, AFROTC, Purdue University, W. Lafayette, Indiana.

During the period October 1957 to May 1960 he was in Wiesbaden, Germany as Commander of the Air Force Exchange Service covering Germany, France, Holland and Italy.

In September 1957 Colonel Merz completed a 3-1/2 year procurement assignment at Headquarters Air Materiel Command (AMC) where he headed the procurement activities for fighter fire control systems and auto pilots and later was Executive to the Deputy for Production. This followed assignments in Air Force Supply and Materiel and studies at the USAF Institute of Technology.

During World War II Colonel Merz served in the U. S. Navy on Destroyer assignments as communications, gunnery, and executive officer.

Colonel Merz was born in Pontiac, Michigan, January 27, 1921. He graduated from the U. S. Naval Academy, Annapolis, Md. in June 1942. In 1954 he was awarded an M. S. in Engineering Administration from the USAF Institute of Technology and received an M. S. in Industrial Economics from Purdue University in 1964. He is a registered Engineer.

## BIOGRAPHY

### COLONEL FREDERIC F. SWAN

Colonel Frederic F. Swan is the Air Force Plant Representative at the Martin Marietta Corporation, Denver Division, Denver (Waterton), Colorado, and Commander of Detachment 10, Headquarters Air Force Contract Management Division (AFCMD).

Colonel Swan was born 18 July 1916 in Shanghai, China, attending the Shanghai American School until 14 years of age. He graduated from James A. Garfield High School in Los Angeles, California, in 1934. He attended the University of California at Los Angeles before he became a civilian flight instructor for Army Primary Cadets in 1942.

In 1943 he enlisted as a Private in the Army Reserves (Inactive) and continued instructing flying cadets at the Hancock College of Aeronautics, Santa Maria, California. Early in 1944, Colonel Swan was commissioned a Second Lieutenant in the Army Air Corps and assigned to the Central Instructors School at Randolph Field, Texas. He continued active flying in the Air Force for 22 years specializing in instrument flight instruction in single and multiengine aircraft. While stationed in Berlin, Germany, he actively engaged in the Berlin Airlift in 1947, flying coal and food to that city in C-54s. He is a Command Pilot with over 6,000 hours in the cockpit.

Colonel Swan's career in procurement and production began in 1953 after graduation with distinction, as an Industrial Engineer, from the resident college of the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio. His three most recent procurement assignments were in Headquarters USAF (Pentagon), the Air Force Inspector General's Office, and Headquarters, Air Force Contract Management Division.

Decorations include the Air Medal, the Medal for Humane Action and the Berlin Airlift Device, and both Army and Air Force Commendation Medals, the latter with two oak leaf clusters.

FRANK D. McDADE  
DIRECTOR, DIRECTORATE OF CONTRACT ADMINISTRATION  
DEFENSE CONTRACT ADMINISTRATION SERVICES REGION, CHICAGO  
O'HARE INTERNATIONAL AIRPORT, P.O. BOX 66475  
CHICAGO, ILLINOIS

Mr. McDade graduated from the University of Georgia in 1938 and received a BSC with a major in accounting. Following graduation, he joined Government service with the Tennessee Valley Authority in Knoxville, Tennessee and served with that agency until being drafted into the Armed Forces in 1941.

Mr. McDade served approximately five years of active duty, was active in the reserve organization prior to being placed on the retired list.

Following military service, Mr. McDade returned to the Civil Service field and has served with the Army Audit Agency, the Ordnance Inspector General Office, and the Chicago Procurement District prior to activation of the Defense Contract Administration Services Region, Chicago in October of 1965.

Currently Mr. McDade is Director, Directorate of Contract Administration, with the Chicago Region which covers the States of Indiana, Wisconsin, and the Northern half of the State of Illinois. The Region is responsible for the administration of approximately 25,000 contracts held by 2,200 contractors. These contracts have a face value in excess of \$3 billion and undelivered dollar balance of over \$1.5 billion. Mr. McDade has staff and operational responsibility for approximately 400 of the 2,100 employees of DCASR, Chicago.



## BIOGRAPHICAL REPORT

COLONEL JESSE M. HAMBY, FR 14290, UNITED STATES AIR FORCE

Colonel Jess Hamby has recently been assigned to DCASR New York from the headquarters staff of the Air Force Contract Management Division, Los Angeles, California, where he had been assigned since July 1965. There he was the Director of Contract Administration and had the responsibility for staff surveillance, providing direction, guidance and assistance to Contracting Officers and other personnel in accomplishing the contracting duties of over 40 billion dollars of Army, Navy, NASA and Air Force contracts.

During 1957 - 1963 he served on the headquarters staff of the Air Force Missile Test Center, Patrick Air Force Base, Florida, as Contracting Officer for the Center's one hundred million dollar Range Contract with Pan American World Airways, Inc., for operation and maintenance of the 10,000 mile National Atlantic Missile Range which extends from Cape Canaveral, Florida, to the Indian Ocean.

During 1953 - 1957 period, Colonel Hamby served with the Procurement Directorate of Headquarters, United States Air Force. He conducted surveillance of Contract Administration functions on an Air Force-wide basis and was promoted to Lt Colonel.

During the period 1950 - 1953, he was stationed at the Central Air Procurement District Headquarters in Detroit, Michigan, where he served as Executive Officer to the Commander, Brigadier General Russell Keillor, USAF.

Born in Holt, Alabama, the son of the James E. Hamby's, he was a student at Birmingham Southern College in Birmingham, Alabama, before enlisting in the Air Force in 1942. He became an aviation cadet and was commissioned as a pilot in August 1943, becoming a Command Pilot in 1958. Additional formal academic education, since becoming an officer in the Air Force, has included attendance at two California Colleges and Wayne University, Detroit, Michigan. He graduated with a bachelor's degree.

PERKINS C. PEDRICK  
SENIOR PROJECT DIRECTOR  
LOGISTICS MANAGEMENT INSTITUTE  
4701 SANGAMORE ROAD  
WASHINGTON, D. C. 20016

Mr. Pedrick has been with LMI since 1963. He is a Senior Project Director and has been engaged in the study of such topics as Life Cycle Costing, Multiple Incentive Contracting, Contractor Motivation, and Contractor Profitability. Since 1965 he has served as consultant to the DoD Life Cycle Costing Steering Group.

Between 1953 and 1963 he was employed (in reverse order of time) in the Organization and Systems Planning Department at Atlas Chemical Industries; the Operations Research Department at Tonche, Ross, Bailey & Smart; the Operations Research Department at the Willow Run Laboratories; and the Production Control Department at the Wheaton Glass Company. His specialty during that period was the design of control and scheduling systems for production, maintenance, inventory, and distribution.

Mr. Pedrick holds a B.A. in economics from Haverford College and an M.S. in mathematics from The University of Michigan. He is a member of Phi Beta Kappa.

His professional activities include membership in The Institute of Management Sciences (TIMS), the Operations Research Society of America, and the Washington Operations Research Council. Currently he is Secretary of the College on Logistics of TIMS.

FREDERICK W. FORMAN, Research Associate, Defense Management Center, College of Administrative Science, The Ohio State University. Mr. Forman is an attorney admitted to the practice of law in the state of Maryland. He is a graduate of The University of Maryland School of Law and of Loyola College of Baltimore, Maryland, where he received the degree of Bachelor of Philosophy.

Mr. Forman retired from the United States Navy with the rank of Commander in May of 1967. Prior to retirement, Mr. Forman occupied the position of Assistant Commandant of The Defense Weapon Systems Management Center, a tri-Service school established to teach management subjects to military and civilian project managers from both Government and Industry. His previous duty at that School was as Director of the Department of Procurement and Production and as a lecturer on various subjects in that field. The last fifteen years of military service were almost entirely devoted to procurement management and government contracting. His responsibilities included giving technical guidance and advice to the Navy Plant Representatives and their contracting officers, in all matters relating to procurement, pricing, negotiation, and administration of contracts for major weapons systems. Other assignments within the management field included responsibility for the formulation of Procurement policy and for the development of long-range plans for the Bureau of Naval Weapons. He has performed such other duties as Contract Negotiator, Termination Specialist, and Legal Officer within the Naval organization.

Mr. Forman is also an aviator with considerable flying experience in large transport-type aircraft. He is a member of the Dayton Chapter of the Federal Bar Association.

COMMANDER JAMES W. KEHOE, USN  
DEFENSE WEAPON SYSTEMS MANAGEMENT CENTER  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

CDR James W. Kehoe, USN, is presently an instructor at the Defense Weapon Systems Management Center (DWSMC), Wright-Patterson Air Force Base, Ohio. DWSMC is a joint DoD activity responsible for the education of senior military and civilian personnel from designated project offices in the life cycle management aspects of weapon systems acquisition.

During the period 1961-1964 CDR Kehoe was the Bureau of Naval Weapons Representative at the Allegany Ballistics Laboratory, Cumberland, Maryland. In 1963-1964 he was involved in the establishment of the DCAS Pilot Test Region of Project 60 as one of the original plant office representatives.

His sea duty experience in aircraft carriers and destroyers includes tours as Chief Engineer, USS WASP(CVS-18); Executive Officer, USS WARRINGTON(DD-843); Operations Officer and Navigator, USS RUSH(DDR-714); and Nuclear Weapons Officer, USS KEARSARGE(CVS-33).

CDR Kehoe was born in Fall River, Massachusetts, September 19, 1928. He graduated from Stonehill College, Massachusetts with a BS degree in 1952 and from San Diego State College, California with an MA degree in 1959.

CONFERENCE REPORT

Panel No. 3  
MANAGEMENT SCIENCE IN  
PROCUREMENT CYCLE

1968 DoD Contract Management Conference

IMPACT 73

# MANAGEMENT SCIENCE IN CONTRACT MANAGEMENT

## INTRODUCTION:

HOW MANY OF YOU THINK YOU KNOW WHAT MANAGEMENT SCIENCE IS? THOSE OF YOU WHO RAISED YOUR HANDS SHOULD HAVE BEEN ON PANEL #3. IN APPROACHING OUR TASK, WE FOUND THAT ONE OF OUR GREATEST DIFFICULTIES WAS TO NAIL DOWN THE TERM MANAGEMENT SCIENCE ITSELF.

## OVERVIEW:

OUR OBJECTIVE WAS TO DETERMINE HOW MANAGEMENT SCIENCE CAN BE APPLIED TO CAS OPERATIONS. THIS MORNING I WILL BEGIN BY:

(1) IDENTIFYING FOR YOU THE DEFINITION OF MANAGEMENT SCIENCE WHICH OUR PANEL AGREED UPON.

(2) TELLING YOU WHAT WE FOUND OUT CONCERNING THE PRESENT BENEFICIAL USE OF MANAGEMENT SCIENCE TECHNIQUES IN BOTH CAS OPERATIONS AND IN INDUSTRY.

(3) DISCUSSING THE DIFFICULTIES TO BE ENCOUNTERED IN THE APPLICATION OF THESE TECHNIQUES.

(4) AND LASTLY, OUR RECOMMENDATION FOR FUTURE USE.

## FINDINGS:

1. THAT THERE IS NO UNIVERSAL DEFINITION OF MANAGEMENT SCIENCE.
2. THAT MANAGEMENT SCIENCE TECHNIQUES HAVE BEEN SUCCESSFULLY APPLIED TO MANAGEMENT PROBLEMS IN INDUSTRY AND GOVERNMENT.
3. THAT CONTRACT MANAGEMENT PERSONNEL HAVE NOT USED MANAGEMENT SCIENCE TECHNIQUES TO ANY APPRECIABLE DEGREE.
4. THAT CONTRACT MANAGERS HAVE NOT BEEN MADE SUFFICIENTLY AWARE OF THE ADVANTAGES OF MANAGEMENT SCIENCE TECHNIQUES.
5. THAT CERTAIN MISCONCEPTIONS HAVE LIMITED THE USE OF MANAGEMENT SCIENCE TECHNIQUES IN CAS.

6. THAT THERE IS A COMMUNICATION GAP BETWEEN MANAGEMENT SCIENTISTS AND CONTRACT MANAGERS.
7. THAT A CRITICAL NEED EXISTS FOR INDOCTRINATION AND TRAINING IN THE APPRECIATION OF MANAGEMENT SCIENCE TECHNIQUES.
8. THAT CERTAIN MANAGEMENT SCIENCE TECHNIQUES APPEAR ESPECIALLY APPLICABLE IN CONTRACT MANAGEMENT.
9. THAT THE GREATEST POTENTIAL REWARD IN THE APPLICATION OF MANAGEMENT SCIENCE TECHNIQUES TO CONTRACT MANAGEMENT IS IN THE AREA OF ALLOCATION AND UTILIZATION OF PEOPLE.

#### RECOMMENDATIONS:

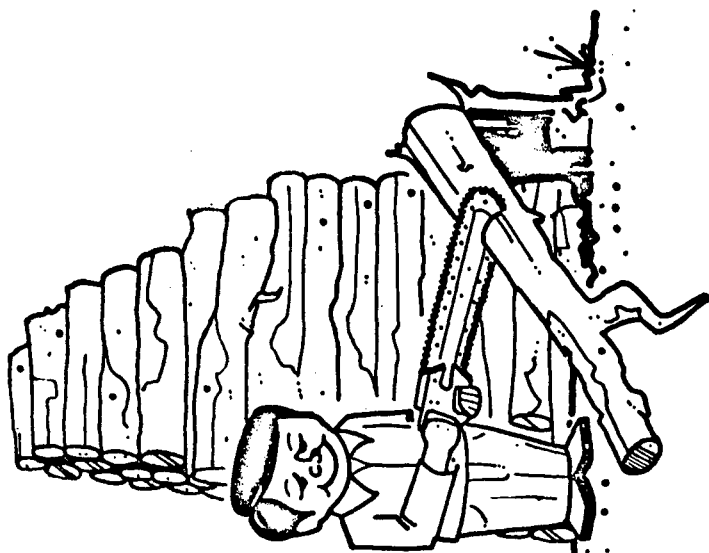
1. THAT A DOD DIRECTIVE BE PUBLISHED REQUIRING CONTRACT MANAGEMENT ACTIVITIES TO ESTABLISH AND IMPLEMENT A PROGRAM FOR APPLICATION OF MANAGEMENT SCIENCE TECHNIQUES.
2. THAT IMMEDIATE ACTION BE TAKEN TO ESTABLISH AN INTENSIVE INDOCTRINATION PROGRAM IN MANAGEMENT SCIENCE APPRECIATION FOR TOP AND MIDDLE CONTRACT MANAGEMENT EXECUTIVES.
3. THAT IMMEDIATE ACTION BE TAKEN TO ESTABLISH AN EXTENSIVE TRAINING PROGRAM IN MANAGEMENT SCIENCE TECHNIQUES FOR SELECTED PERSONNEL AT HEADQUARTERS AND FIELD ELEMENTS OF CONTRACT MANAGEMENT ORGANIZATIONS.

#### CONCLUSION:

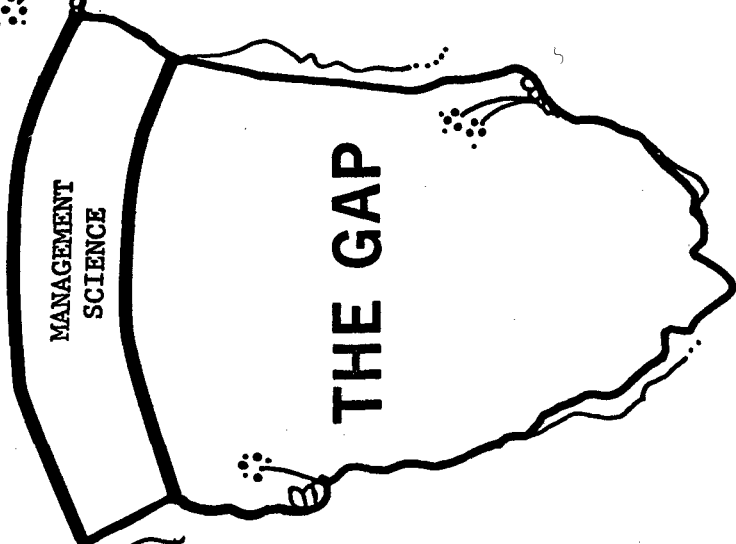
IT IS CLEAR THAT THERE HAS NOT BEEN MUCH MANAGEMENT SCIENCE ACTIVITY IN DOD CONTRACT MANAGEMENT. MANAGEMENT SCIENTISTS KNOW LITTLE OF THE CONTRACT MANAGERS' PROBLEMS AND, CONVERSELY, CONTRACT MANAGERS FAIL TO APPRECIATE THE UTILITY OF MANAGEMENT SCIENCE IN THEIR AREAS OF WORK.

# **MANAGEMENT SCIENCE IN CONTRACT MANAGEMENT**

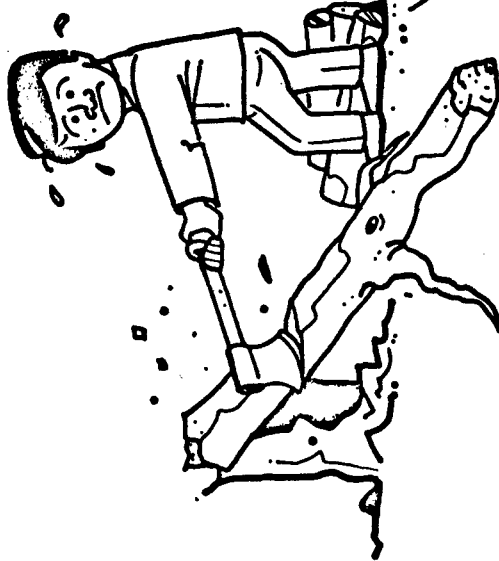




1973



TODAY



## **O V E R V I E W**

### **O O B J E C T I V E S**

### **O F I N D I N G S**

### **O R E C O M M E N D A T I O N S**

## **FINDINGS**

- O MANAGEMENT SCIENCE DEFINITION**
- O USE IN INDUSTRY & GOVT**
- O USE IN CONTRACT MGT**
- O CAS NEED FOR AWARENESS**
- O MISCONCEPTIONS**

**F I N D I N G S    (Cont)**

- O    COMMUNICATIONS GAP**
- O    NEED FOR APPRECIATION TRAINING**
- O    TECHNIQUES APPLICABLE TO CONTRACT MGT**
- O    GREATEST POTENTIAL - PEOPLE**

## RECOMMENDATIONS

- O ESTABLISH MS PROGRAM
- O MGT INDOCTRINATION
- O TRAINING PROGRAM

### PANEL #3

#### MANAGEMENT SCIENCE IN CONTRACT MANAGEMENT

##### PROBLEM:

To determine how Management Science can be applied to CAS operations.

##### FINDINGS AND DISCUSSION:

###### A. Definition of Management Science

Definitions of Management Science (MS) vary and have changed over the years. It has been described as a method which provides a quantitative basis for management decisions; it has been identified as a set of theories and techniques (e.g., probability, queuing, games, linear programming, renewal, search); and it has been called the application of the scientific method to certain classes of problems (e.g., resource allocation, production scheduling, inventory control, portfolio selection, blending, maintenance analysis). Such definitions are out of vogue now. The experts say that MS isn't restricted to quantitative methods and cannot be defined by techniques and problems any more than "physician" can be defined by lists of medicines and maladies. But despite agreement on the inadequacy of old definitions there is not much agreement on a new one. Some of the new versions are: (1) applied decision theory; (2) a new language applied to decision-making; (3) examination and explanation of phenomena concerning man-machine systems by objectivity and logic; and (4) a movement increasing the manager's ability to generalize.

For purposes of this paper MS is defined as "the application of scientific methods in solving management problems."

The trend is toward distinguishing management science by how it conducts its investigations. It expresses management problems in language different from that of the problem environment. It then manipulates that symbolic representation (model) in an attempt at solution.

Methods and techniques employed in management science include:

Probability and Statistics	Game Theory
Linear Programming	Automatic Feedback (Cybernetics)
Dynamid Programming Simulation	Information Theory
Symbolic Logic Methods	Cost Benefit Analysis
Queuing Theory	Network Analysis
Decision Theory	Input-Output Modeling
Search Theory	Automatic Data Processing

## B. Development of Scientific Management

The modern era of scientific management developed during and after World War II as the result of the compelling need of both Government and industry to accelerate decision-making processes to match the remarkable technological advances emanating from the physical sciences - atomic power, inter-planetary travel, jet propulsion, automation, mechanization, and computerization. The progress made in these areas created an insatiable demand for management tools which would provide a medium of scientific approach to the solution of the myriad problems resulting from this new technology.

A generally accepted approach to this dilemma was found some 25 to 30 years ago in the program of Operations Research. For a period of several decades, very few executives and technicians, except the initiated, understood or appreciated the objectives, principles, and techniques of Operations Research. It wasn't until 1962 that the Council of the Operational Research Society of the United Kingdom published the following official definition of Operations Research.<sup>1</sup>

Operational Research is the attack of modern science on complex problems arising in the direction and management of large systems of men, machines, materials, and money in industry, business, Government, and defense. The distinctive approach is to develop a scientific model of the system, incorporating measurements of factors, such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies, or controls. The purpose is to help management determine its policies and actions scientifically.<sup>2</sup>

From this definition it is apparent that the nature of Operations Research is scientific methodology (and particularly mathematical, statistical and actuarial techniques) applied to the construction of predictive models which simulate real problems involving decision-making and value judgements on the risks of alternative courses of action.

## C. Need for and Benefits of Management Science

The claim can justifiably be made that enlightened management has always sought to acquire all the facts, a knowledge of all the alternatives, and the probable impact of actions taken. Skeptics will question what is

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<sup>1</sup> Operations Research (or Operational Research, as it is called in the U.K.) is addressed to the solution of operational problems, whereas Management Science is directed at management problems. Both disciplines employ the same scientific methods, however, and so both call upon the same techniques. For the purposes of this paper they will be considered essentially synonymous.

<sup>2</sup> OPERATIONAL RESEARCH QUARTERLY, Vol 13, No 3, 282, September, 1962

so new or magical about operations research that hasn't been tried before. The informed management scientist will counter with the thesis that operations research will:

1. Open up new in-sight into possible alternatives and consequences of action.
2. Provide a more concrete basis for decision by requiring managers to express alternatives in quantitative terms.
3. Set up mathematical and statistical tools which can be brought to bear on a distinct problem.
4. Provide improved understanding of a system's over-all operations by constructing a mathematical model incorporating all significant variables and their inter-actions. This model may be used predictively by manipulating its variables to ascertain the probable outcomes of the alternative actions possible.
5. Provide new means of measuring the effectiveness of a system.

The need to apply scientific techniques to CAS management problems is apparent. There are massive volumes of data to be processed, analyzed, and applied to on-going business rapidly. Communications between diverse elements of a world-wide military-industry complex must be in compatible language. The need for feedback and interchange between program manager, PCO, ACO, and user is vital. Machine data processing capabilities of industry force a commensurate capability in contract management offices.

#### D. Problems in Applying Management Science to CAS Operations.

To apply the methods of MS to real problems, the interests of the executive and management scientist must be coordinated. The executive in many cases is mathematically illiterate and may be impatient with "probabilistic" answers because he suffers the delusion that an exact answer is always attainable. This gap in communications between the executive and the technician can be bridged only by mutually greater understanding and appreciation of the other's problems and a drawing-together of common knowledge. This requires an intellectual curiosity on the part of both to understand the rudiments of operations research on the one-hand and decision-making on the other. To expect contract managers to seek the aid of MS is to deny some prevalent misconceptions about MS. It is a waste of time to discuss uses of MS in contract management until those misconceptions are faced.

#### E. Common Misconceptions about Management Science

1. That MS consists of the direct use of ready-made models  
Ready-made models frequently are not available for the type problem at hand, and even when they are, substantial tailoring is almost always necessary. When managers look at existing models and consider direct application to their real problems, it is no wonder they are pessimistic.



## 2. That MS is a substitute for judgement

In practice, MS efforts are rarely successful without heavy participation on the part of the people who have day-to-day familiarity with the problem studied. Subjective judgement is required in diagnosing the problem, developing a symbolic representation, interpreting the solution obtained, and in implementing the solution. The solution is seldom an optimum, but usually just a step in that direction. And the solution more often than not is really a partial solution and must be used along with other information and "management savvy" in making decisions.

## 3. That mathematics is the language of MS

MS has two languages in each application: the language of the problem environment and the language of the model. Neither one necessarily is mathematics. (The model might well be non-mathematical; e.g., an accounting model, a computer program, or a management game).

Since two languages are involved, a need for translation exists. The lack of a translator - someone who understands both the language of the model and that of the problem environment, and can assure communication in both directions - is a critical impediment in many potential MS applications. That lack, in view of the next misconception, probably indicates that the use of MS requires three types of individual: a MS practitioner, a manager with a problem, and problem-oriented "middle man" who is conversant (though not necessarily creative or proficient) in the technical disciplines involved, and is comfortable in the methods of science (use of abstract structures, hypothesis testing, etc.). Charts I and II illustrate the need for a communications medium to translate between the manager and the management science technician.

## 4. That management scientists and managers are interested in working with each other

It is simply not natural for the management scientist highly trained in the formulation and manipulation of models to be fascinated by all the practical problems of an on-line manager. The scientist enjoys developing theorems and techniques, without pressures to conform to the real world in his assumptions. On the other hand, managers are oriented to real situations, not to symbolic representations. They are suspicious of techniques with which they are unfamiliar, and they do not enjoy the type of theorizing and experimentation which delights the scientist. Managers look upon the use of MS as a sharing of decision making with persons who do not understand the problems involved or share the responsibility. Hence, the managers are reluctant.

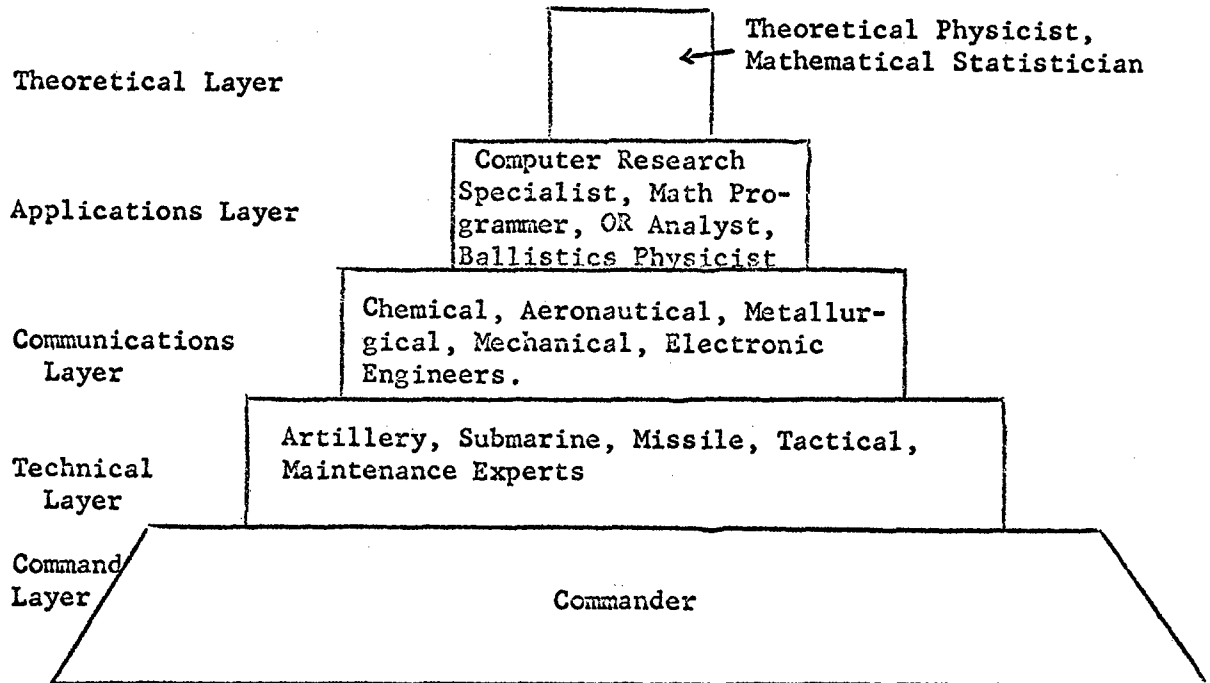
## F. Suggested Management Science Methods for Emphasis

It is crucial that the application of MS in contract management be planned so as to obtain the support of contract administrators, build their confidence for future applications, and avoid serious problems of translation between managers and management scientists. Those objectives seem to dictate that the emphasis should be placed on applications which are simple

OPERATIONS RESEARCH  
PROBLEM-SOLVING HIERARCHY

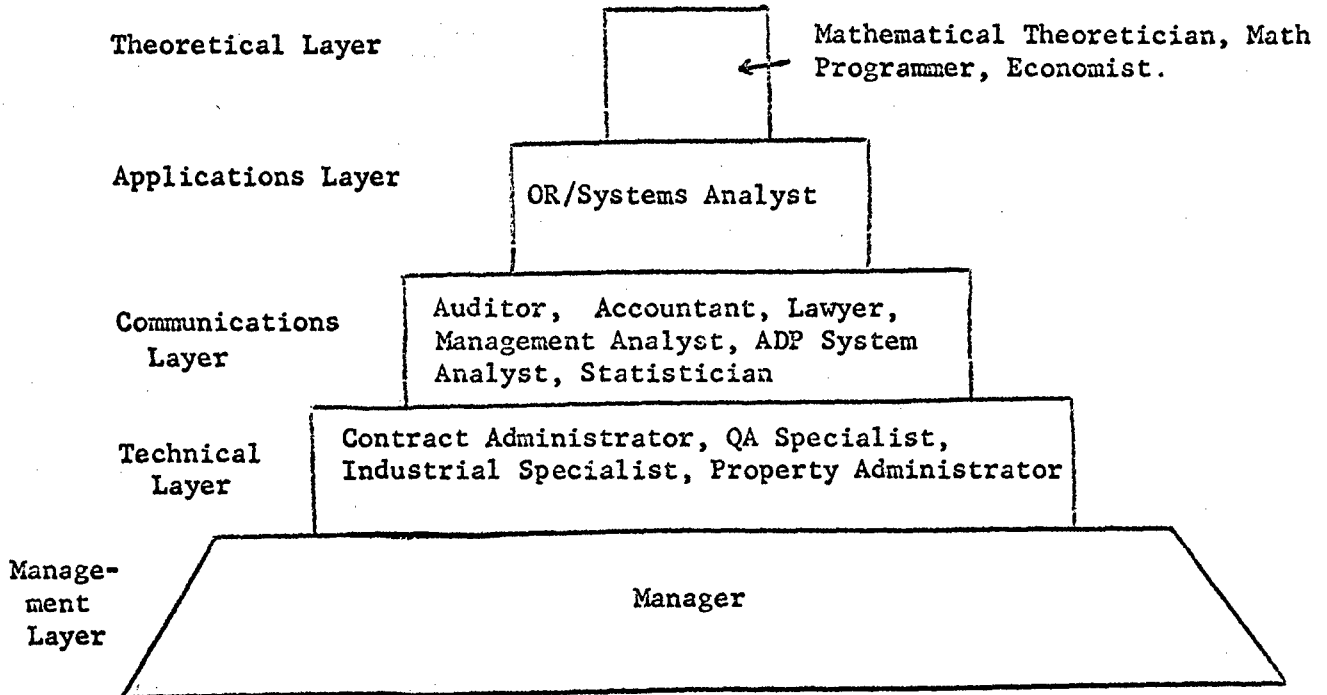
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WEAPONS DEVELOPMENT



MANAGEMENT SCIENCE  
PROBLEM-SOLVING HIERARCHY

CONTRACT MANAGEMENT



and have a high probability of success. In addition, concentration should be placed on MS areas which have large potential for future application in contract management. Current emphasis should be placed on statistics and simulation techniques, gradually building from their simpler to their more complex forms.

Statistical techniques are the most useful of all MS techniques for administrative functions. Sampling, forecasting, and analysis of data apply throughout the contract management area. Use of simple probabilistic models can assist in choosing among alternative actions (e.g., whether to expedite, which schedule to accept, when to require completion of a related activity). Work force and budget projections and forecasts of the geographical mix of contract dollars are problems which might be addressed.

Simulation is another fruitful area. Effort in this area could build gradually from simple systems charting and gaming to large scale computer simulation. Some problems which might be addressed are size of administrative staff, numbers of inspectors, and choice of progress reporting system.

Once groundwork has been laid by some successful application of statistical and simulation techniques in CAS operations, a more ambitious across-the-board program can be instituted.

#### G. Industry Applications of Management Science

Management science methods and techniques have been applied to a wide range of applications in industry. These include:

Commodity Markets  
Communications  
Inventory Control  
Labor Stabilization  
Maintenance Analysis  
Petroleum Blending

Production Control  
Research and Development  
Planning  
Sales Forecasting  
Transport Schedules  
Warehouse Location

Though these techniques are particularly suited to large and complex operations and systems, these methods may be scaled down for application to problem-solving at almost any level of an organization.

#### H. Management Science in the Department of Defense

Investigation identified numerous private operations research organizations already in being within DoD. The advanced management sciences have been much more widely accepted and are being more fully utilized in the weapons development and strategic planning areas than in the logistic and organizational management side of the military departments. Although emphasis is generally on the strategic-tactical-weapons development side rather than on the management side, this does not necessarily preclude their use on management projects.

Air Force  
Army  
Navy  
Air Force  
OASD (COMPT)  
OASD (I&L)

Rand Corporation  
Research Analysis Corporation  
Center for Naval Analysis  
Aerospace Corporation \*  
Institute for Defense Analysis \*  
Logistics Management Institute \*

#### \* Management Orientation

In addition to these, a number of universities have established associated organizations which are employed exclusively by the Services: e.g., George Washington University's "Human Resources Research Organization," which is under contract to the Continental Army Command.

Within all three services and DSA, MS exists as a staff element at almost all command levels. The organizations are listed under many names - Management Engineering, Management Analysis, Management Appraisal, ADP Systems Analysis, etc. Functions range from operations research to statistical review and analysis. Most are used for management studies employing organization, procedures, and methods analysis techniques of varying degrees of sophistication.

In the typical headquarters organization in all services, MS runs down a double track - the weapons development/tactical track and the management track. The management track itself has become a double one with systems analysis appearing in the comptroller area paralleling organizationally the conventional management analysis elements. This pattern is generally found in the major subordinate logistic commands of all three services.

In both DSA and the Army, MS is included in the comptrollership or financial management career fields. At a DoD conference in July, it was agreed not to move into a DoD-wide career program in this area until both the Navy and Air Force have established one of their own. Both Services are studying the Army set-up. Headquarters DSA has an operations research department and a management analysis staff and their policy is that DSA will give MS support to DCAS. Headquarters DCAS has a Management Analysis Staff in its Office of Plans and Management. At the present time, there seems to be no deliberate plan to use MS to solve CAS problems.

#### I. The Need for Management Science Appreciation

It has been said that operations research succeeds well in the weapons development area because of the engineer-link. The same techniques have not been exploited in management due to lack of orientation of managers concerning the availability and use of MS as well as lack of, or non-recognition of the necessity for, the communications linkage. Successful application of MS techniques requires that managers understand what MS can do for them and that they develop a "trust" of MS.

There is a need for intensive training of managers in MS appreciation. Such training is available from several Government agencies, schools,

and institutions. As an example, the Civil Service Commission offers in its MS education program a course titled "Application of Operations Research for Executives". Also, the Army Management Engineering Training Agency has a course in Operations Research Appreciation.

#### J. Availability of Management Scientists

Several universities are granting degrees in operations research. Many military officers - mostly at the 03, 04, 05 levels - are obtaining advanced degrees in management science-related fields at the Air Force Institute of Technology (AFIT), Naval Post Graduate School, and at civilian institutions. In the Washington area alone, five Government agencies and seven universities are offering day and night curricula in MS and related disciplines. The AFIT School of Engineering and Department of Systems Management grants about 25 degrees a year to senior officers. Most of these officers are destined for assignment in AF project management offices; few are experienced in contract management. The AFIT School of Systems and Logistics likewise grants about 100 degrees per year in a management science-related curriculum. The school plans to accelerate its output to 200 per year by 1974.

#### K. Application to Contract Management

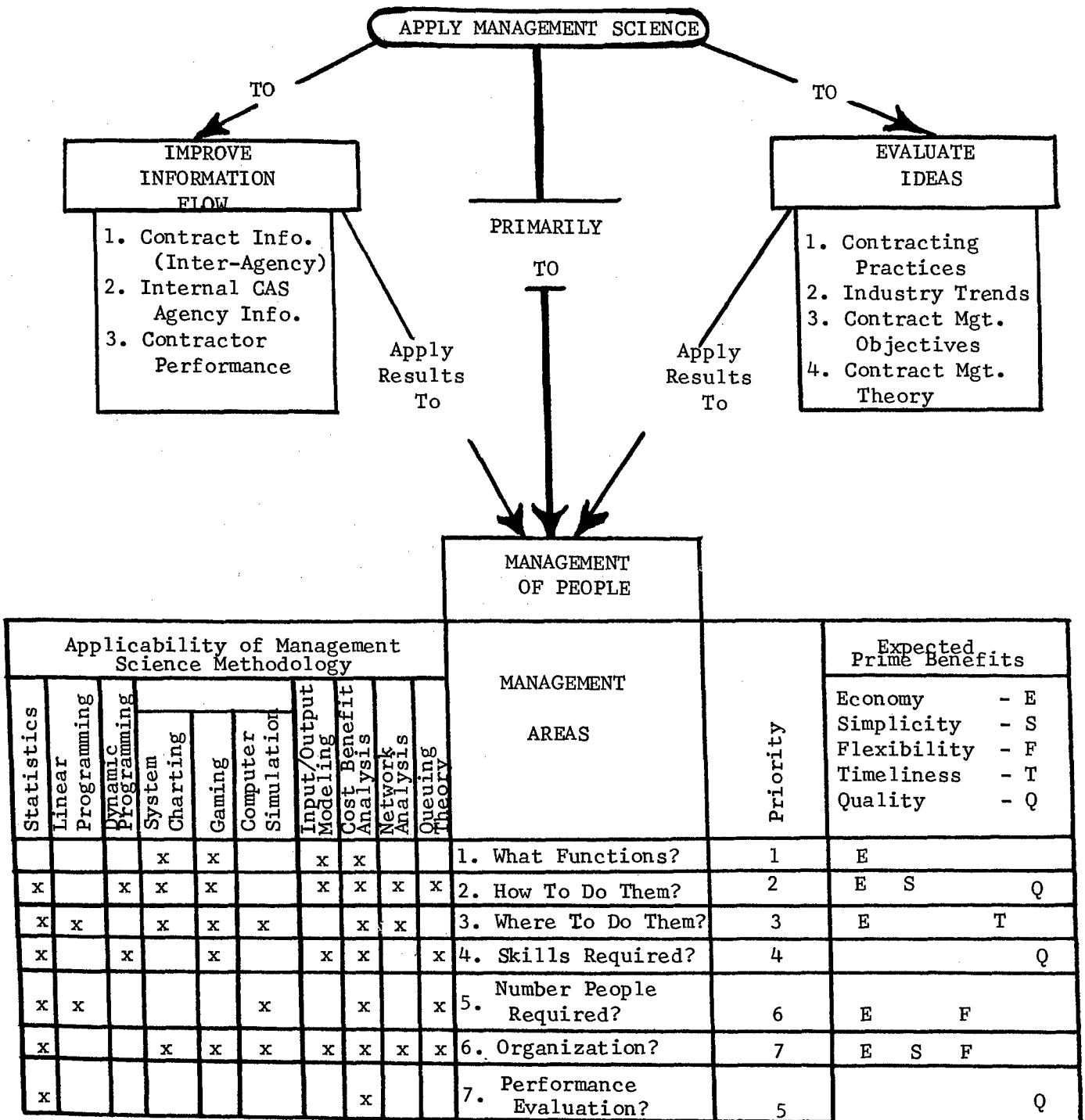
The CAS area of greatest potential reward is the application of MS techniques to management of people. CAS operations are accomplished through people, in an hierarchy of many layers. The problems of contract managers, from the highest to lowest levels, are predominantly people management problems. Some of these problems stem from the fact that although some field technicians handle hardware and operate machines (such as aircraft during acceptance testing), most CAS people handle a massive flow of information. This is the second characteristic of the CAS environment. The third is the constant need for, and exchange of, ideas. Thus, the techniques of MS, developed in the past to optimize military operations, improve industrial practices, and manage the acquisition of complex weapon and space system hardware, must be applied to the direction, allocation, and performance of people, along with their basic tools: information and ideas. It would appear that here the highest potential reward can be achieved. A Pictorial Summary (Chart III) of this is shown on the next page.

The illustration shows the seven fundamental areas for formal application of selected management science techniques to problems concerning people: (1) what they should do, (2) how they should do it, (3) where, (4) what skills are required, (5) how many people are needed, (6) how they should be organized, and (7) how their performance should be measured and evaluated.

This chart could be used as a road map for the progressive examination of all areas of CAS operations using MS techniques.

# PICTORIAL SUMMARY

"The Application of Management Science  
to Contract Management"



Some of the expected benefits are shown on the lower right side. In addition, priorities are listed for the management areas concerning people. In this respect it should be noted that more priority attention has been given to the use of statistical techniques to establish manpower standards (i.e., how many) than in five of the other management areas, although determining the number of people required probably should have a lower priority (based on systematic evaluation of what must be examined first).

The recommended MS techniques for application to the people problem areas are shown on the lower left side, with expected applicability checked for each management area.

A brief examination of the potential rewards which would stem from this approach are as follows:

Improve Information Flow. The primary current thrust is inter-agency flow of automated contract information (MILSCAP). But how about internal agency automation? DCAS is developing its MOCAS system. How about in the larger plant residencies? What areas would be materially improved if internal computer programs were developed? Some under current experimentation are: master (single) listing of all contract administration delegations (ACO, Quality, Production, and Engineering) with other pertinent data for plant-wide use (to eliminate redundant and type-written listings); Automated Master Register of Pricing Cases with all responsibility assignments listed, due dates, progress, values, etc., for management visibility plant wide covering this dynamic workload; independent government computerized listing of contract end item requirements for cross-check on contractor compliance with directed hardware configuration (control of changes). Still to be fully explored is "How can data on contractor performance effectively flow for timely use?"

Evaluate Ideas. The administrative functions of contract management have developed over the decades. Hopefully, examination of their current validity and the opportunities for optimization should produce high rewards. Demands are currently heard, for example, to determine what efforts can be dropped in an environment of fixed-price incentive contracting and the total package procurement concept.

Results of formal studies in the above two areas can then assist, and be a part of, the studies in "Management of People" area. For example: What Functions Should be Performed? What trade offs among field CAS operators, higher headquarters, and the buying agencies would improve economy? Under current procurement practices what functions can be dropped? or added? System charting, gaming, input/output models and cost benefit analysis could be used, for instance, in definitizing the optimal functions of field development engineers. How should functions vary by contract type? Should they vary according to past contractor performance?



How Should Functions be Performed? The Quality Assurance function has undoubtedly received more benefit from MS application than any other CAS function. Its evolution from 100 percent government inspection, through reduced inspection, to surveillance, reflects this clearly. High priority should be given to applying such techniques as dynamic programming, system analysis simulation, network analysis, cost benefit analysis, and queuing to the many other functions suitable for such analysis. For example, cost proposal analysis (pricing) is a high-volume operation using a great share of CAS resources. Is the flow right? How about work scheduling for most economical queuing of workload? Would statistical sampling be effective? Would more automation help? Other functional areas would benefit too; such as government property surveillance, industrial engineering evaluations of contractor operations, configuration management in major systems, and contractor performance evaluation.

Where Should CAS Functions be Located? Should functions be centralized or decentralized? This is a continuing management question in constant flux. Today automation and rapid communication provide management choices unavailable before. By 1973 the options will be significantly greater. Can an intermediate CAS headquarters be eliminated? Or a plant residency removed? Can a plant function be done centrally in a headquarters or new suboffice? Where should the office be located? These and other questions can and should be attacked systematically using the MS techniques suggested in the Chart III.

What Skills are Required? By 1973, what will be the impact on skills required in CAS due to changes in procurement techniques, automation, industrial management and technology? What new skills will CAS management need? How about the operators in the field? Some MS techniques would be useful in this area.

How Many People Does CAS Need? Although DSA and the Services have already initiated programs to control manpower through application of standards statistically derived, there is considerable dissatisfaction with the results, so far. Even the experts in this management engineering effort will admit there is much to learn before there will be more valid work measurement and forecasting in the varied and changing CAS environment. This appears to be a fruitful area for continuing effort.

Can the Organization be Improved? There are many MS techniques suitable for formal examination of questions in this area. They could be used to explore perhaps, the traditional subdivision of plant-level functions which have been developed during past years. Is it still the most suitable? Would a "Contract Requirements Division" effectively combine certain "what does the contract say" functions now separately performed by the Contracts, Quality, Production, and Engineering divisions? Likewise would a "Contract Compliance Division" effectively combine the balance of the functions? Would this give more economy, effectiveness, and management control? These same questions could be answered at any headquarters level.

How Well are People Performing? Effective evaluation of the quality of performance in CAS, where there is a large output of paper and ideas, has always been elusive. There is undoubtedly a considerable flow of questionable performance data in CAS as in many other activities. Performance evaluation of people and organizations is a must for effective management. Unfortunately, the problem does not appear to lend itself easily to solution by classical techniques. It is a great challenge that needs answering.

The foregoing discussion and charts have outlined a long range program. It is enough to scare the timid and challenge the bold. Too ambitious an attack could, however, seriously jeopardize its ultimate success. Long run benefit will be maximized by a modest start and gradual development, beginning with simpler applications and techniques.

## CONCLUSIONS:

1. That there is no universal definition of management science.
2. That management science techniques have been successfully applied to management problems in industry and government.
3. That contract management personnel have not used management science techniques to any appreciable degree.
4. That contract managers have not been made sufficiently aware of the advantages of management science techniques.
5. That certain misconceptions have limited the use of management science techniques in CAS.
6. That there is a communication gap between management scientists and contract managers.
7. That a critical need exists for indoctrination and training in the appreciation of management science techniques.
8. That certain management science techniques appear especially applicable in contract management.
9. That the greatest potential reward in the application of management science techniques to contract management is in the area of allocation and utilization of people.

RECOMMENDATIONS:

1. That a DoD directive be published requiring contract management activities to establish and implement a program for application of management science techniques.
2. That immediate action be taken to establish an intensive indoctrination program in management science appreciation for top and middle contract management executives.
3. That immediate action be taken to establish an extensive training program in management science techniques for selected personnel at Headquarters and field elements of contract management organizations.

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Seated left to right: Capt. Holfield, Col. Swan, Col. Merz, Col. Chealander, Mr. Williams, Mr. Pedrick, Mr. Forman, Capt. Dunn, Standing left to right: Col. Hamby, Mr. McDade, Mr. Head, Cmdr. Kehoe